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THE JOURNAL OF
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A SURVEY OF CLINICAL PROCEDURES IN THE DIAGNOSIS AND TREATMENT OF POOR READING

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Psychological clinics[1] offering services to poor readers were asked, in 1940, to participate in a survey of their facilities and practices. A generous response was received: fifty-eight clinics, located in every section of the country but the Southeast, submitted useful information. Forty-one of these centers filled out and returned a comprehensive questionnaire, providing the data for most of the tabulations of this study. The representative character of the sample is discussed in another article[2] which also contains an analysis of clinic personnel, clientele, and administrative organization. The present article summarizes what these clinics do with poor readers: how they are examined; what tests and materials are employed; how reading difficulties are interpreted and treated; how effective the reported therapies are estimated to be; what research is in progress and what problems are cited as needing investigation.

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*On leave to the Army of the United States.

[1] The term 'psychological clinics' is used broadly to include laboratories, centers, institutes, etc., which describe themselves further as 'psycho-educational,' 'psychiatric,' 'child guidance,' 'mental hygiene,' 'reading,' etc.

[2] Kopel, David and Geerdes, Harold: "A Survey of Clinical Services for Poor Readers." *Journal of Educational Psychology*, Vol. 33, March, 1942, pp. 209–220.

THE PATTERN OF DIAGNOSTIC PROCEDURE

The findings reported in this section are intimately related to data concerning clinic organization which were presented in our earlier paper.[1] There we pointed out the wide variations which exist among clinics in size of staff, amount and type of training of personnel, the amount of time devoted to clinic duties, and the form of clinic organization. All of these factors influence considerably the nature, sequence and comprehensiveness of the steps taken to elicit the causes of an individual's reading difficulties.

In general, the more adequately staffed clinics follow some type of case-study method which entails the collation of salient data concerning the individual's mental, physical, social, emotional, and educational development. Information is obtained through interviews (by psychologist, social worker, physician, or other clinician) with parents, teachers, and subject; and by examination of school and other records. Primary data concerning the individual's present status in the several areas of development are obtained through the use of various standardized and informal tests, scales, and questionnaires; and through observation of the individual's attitudes, approach to reading and other tasks, and general reactions during the testing period.

Examples of relatively elaborate diagnostic outlines, showing the steps usually followed in the examination of a poor reader are given below:

Clinic A:

1) Interview parents and child.

2) Give an intelligence and also an oral and silent reading test to determine whether or not the child is a real reading problem.

3) Social worker takes history from parents while psychologist continues giving general, specific, and diagnostic reading tests, and personality tests. The diagnosis is completed as soon as possible.

4) Psychiatric interviews.

5) Physical examinations (when indicated) by pediatrician, neurologist, endocrinologist and speech specialist.

6) Summary of findings and conference by entire group.

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[1] *Ibid.*

7) Recommendations made to parents and referring agency.

Clinic B:

1) The clinic directors talk with the child about (a) what he likes to do in and out of school [an interest inventory is very helpful here]; (b) they try to discover his attitudes toward his school, his teachers, his companions, his parents: (c) they try to find out what the child can succeed in; (d) they try to build up a desirable attitude toward the examiner and the reading clinic.

2) The child is exposed to some six or twelve books and his selections are noted in regard to (a) interests; (b) level on which he prefers to read.

3) The subject is requested to read orally (after examining the books) anything he likes.

4) The informal testing is continued with a discussion of material read. The level, the habits, the skill, and the subject-matter are noted.

5) The teacher or parent is consulted, not in the presence of the child.

6) At this or a later visit to the clinic, standard tests are administered.

7) An effort is made to stimulate the child's interest in his own improvement.

8) Recommendations are made to the teacher, including possible ways of overcoming the child's specific difficulties, level at which he can read successfully, his language needs, his interests as they have been revealed in his conference, etc.

9) The teacher is urged to find out as much as possible about the child's environment; his interests; his physical condition.

10) The Betts visual tests are administered.

11) A mental test (generally the Stanford Binet-Simon, Revised) is used.

12) A request is made for
   (a) a report on the child's progress.
   (b) at least one other visit to the clinic.

Comprehensive diagnoses such as have been described require a relatively elaborate organization. Where clinic staffs are small there is a tendency naturally for some parts of the full routine to be omitted or elided. Thus the clinic which lacks the

services of a psychiatrist will obviously not include a full neurological examination. In clinics which do not employ social workers, the case history is taken usually, in a more or less abbreviated fashion, by the psychologist or student assistants.

On the other hand, some small as well as large clinics have part-time or full-time specialists who provide meticulously thorough and complete examinations of that function (related to reading disability) in which they are interested. Thus, one university clinic which has pioneered in the study of certain visual anomalies, makes a comparatively elaborate appraisal of vision by means of "standard optometric instruments; also eikonometer [for measuring inequalities in the size and shape of monocular images]; survey tests of vision such as the telebinocular (with much stricter standards for determination of defectiveness than in manual); eye movement camera with some children; visual perception and eyedness tests."

Variations and trends in clinical procedures will be discussed more systematically in the following section, which is devoted to an account of the measures employed to appraise functions which most commonly receive clinical attention: vision and hearing; other perceptual and motor abilities, laterality, speech, and general health; mental status; emotional adjustment; vocational and special aptitudes; reading and other educational achievements.

DIAGNOSTIC APPRAISALS

Of vision and hearing.—Patently invalid or limited procedures for appraising vision were reported by very few clinics. Thus one clinic used only the Snellen Chart. Another clinic utilized the "reports of the school nurse," which may safely be interpreted to mean similarly a Snellen test score. While this device was employed in fully a third of the clinics, it was supplemented as a rule by other procedures. Three clinics failed to report any visual tests. On the other hand, approximately sixty per cent (twenty-four) of the clinics employed the Betts Telebinocular, and, in some instances, additional procedures as well. In twenty-five per cent of the clinics, visual testing was performed by affiliated eye specialists and doctors or by the patient's private physician.

The Snellen test mentioned above yields crude measures of visual acuity and astigmatic error. The Betts tests are more accurate and provide, in addition, appraisals of muscle coördination and fusion, as well as of letter and word perception when the full set of cards is used. Eye specialists may or may not appraise all of these functions.

For determining auditory acuity, only five per cent of the clinics depended solely on the whisper test; sixty-five per cent employed some type of audiometer; another twenty per cent obtained medical appraisals; and the remaining ten per cent apparently ignored this function.

Of eye-movements, color-blindness, visual fields, motor skills, laterality, speech, and general health.—Eye-movements were observed informally in several clinics; nine centers employed a special camera, the Ophthalmograph, for this purpose. Eye and hand dominance, the most commonly noted aspects of laterality, were ascertained in a third of the clinics. The use of color-blindness tests was reported by one clinic, measurement of the extent of visual fields and blind spots by another. Several centers employed tests of motor control and coördination, reaction time, aphasic status, and of speech.

Medical services and practices varied considerably from clinic to clinic. Thus seventeen per cent of the clinics required patients to obtain medical examinations from their private physicians; another sixth depended solely upon health reports from school doctors and nurses; a similar proportion had no medical facilities and seemed to give no attention to general health in their diagnostic procedure. The remaining fifty per cent, approximately, of the centers boasted staff physicians, most of whom devoted full time to clinic duties. However, only half of these doctors included more than eyes and ears in their health appraisals. A partial explanation of this finding may be that many medical doctors had other major responsibilities, since a third of them were listed as staff psychiatrists and also, in some instances, as directors of their respective clinics. Moreover, some of these clinics had access to health reports from referring schools.

Although systematic and thorough health examinations were provided in some centers, they are definitely not a part of the typical clinical routine. Indeed, the consideration given general health in most clinics tends to be rather cursory. Poor readers

as a rule perhaps do not need exhaustive medical examinations, but the prevailing type of health appraisal seems, nonetheless, inadequate probably for identifying many physical etiological factors.

Of mental status.—In administering mental tests all clinics used the Terman, Terman-Merrill, or Kuhlmann revisions of the Binet-Simon as their basic procedure. This was supplemented in all but three of the clinics by a non-verbal test such as the Arthur Point Scale, Merrill-Palmer, the Porteus Maze, Pintner Non-Language, Cornell-Coxe, or some part of a performance battery. Of the verbal group tests which were also used in some centers, the Terman, Otis, and Kuhlmann-Anderson dominated the field. Several non-verbal group tests also were mentioned: The Detroit Learning Aptitude Tests, Durrell-Sullivan Test of Reading Capacity, and the revised Army Beta. Special provision for the hard of hearing and the visually handicapped, respectively, was reported by one clinic which cited the Herderschee and Hayes tests.

Of emotional adjustment.—Appraisals of emotional adjustment were omitted in thirty per cent of the clinics. In the remaining centers, the most common procedure consisted of observations of the child's general reactions and administration of some personality schedule, rating scale, or other paper and pencil test. Mentioned several times each were the Bernreuter Personality Inventory, the Bell Adjustment Inventory, the Rogers Test of Personality Adjustment, the Pintner, *et al*, Aspects of Personality Test, and the Maller Character Sketches. The Rorschach Ink-Blot Tests and other projective techniques were employed in four centers. Various other instruments were cited by single clinics.

Another common procedure, reported by fifty per cent of the clinics, was the psychiatric interview with the subject and, sometimes, with his parent. Psychologists and social workers performed this work in some clinics, although the task was usually delegated to a psychiatrist in the clinic, or in an allied agency. Social and psychiatric social workers were reported only in clinics (with but three exceptions) which were staffed by psychiatrists.

Of vocational and special aptitudes.—Only a fifth of the clinics reported that they administered tests of vocational and special aptitudes or interests. Among the instruments mentioned were the Minnesota, Stenquist, and Detroit tests of mechanical apti-

tude, the Lewerenz Art Test, a music appreciation test, a motor coördination test, the Strong vocational interest inventory, and the Witty-Kopel and Hildreth general interest inventories.

Of achievement in subjects other than reading.—Since most clinics diagnose reading disability partially in terms of the disparity between performance in reading and in other subjects, they naturally follow the practice of examining school marks and administering general achievement tests. Practically all of the well-known batteries were mentioned. Separate arithmetic and spelling tests were also employed in many centers.

Of reading ability.—A standardized test was employed universally. Cited most frequently, in the order of their popularity, were the Gates, Durrell-Sullivan, Monroe, Gray Oral, Iowa, and New Stanford tests. Practically all of the other well-known standardized reading and reading-readiness tests were mentioned. In many clinics one or two tests were favored and were administered to every individual; the majority of clinics selected from a relatively small list of three to six instruments.

Although standardized reading tests are known to have serious limitations in scope, and to be of dubious reliability and validity, over one-half of all clinics apparently appraised reading ability and defined reading retardation through such means exclusively. In the other centers, supplementary information was obtained through one or more of the following procedures: interviews with the poor reader and his teachers, observation of attitudes toward books and reading tasks, informal tests of phases of reading not measured by standardized tests, oral reading of passages, oral spelling, and examination of recreational reading choices.

All of the foregoing procedures were rarely employed in any clinic, although it would appear desirable to do so. Most clinics seem to depend too heavily upon standardized test results for determining reading status. Very few clinics are sufficiently concerned about the necessity of ascertaining for each patient: how well he reads in different types of materials, his background of reading experience, and his present reading interests and attitudes.

PROBLEMS ASSOCIATED WITH READING DISABILITY

In addition to providing information about the subject's reading disability, the diagnostic procedures described above

usually revealed the existence of additional difficulties or problems. Seventy-seven per cent of the clinics reported that none or very few of their reading cases were free from such complications.

The diversified problems named by these clinics were classified in three broad, overlapping groups. Comprising the first group were deficiencies or irregularities of vision, hearing, speech, health, and dominance. Mental retardation and 'slow-learning' made up the second group of associated problems. The third and broadest as well as most frequent type of problem included neurotic tendencies, ungovernability, aggressiveness, associability, disinterest and apathy, personality conflicts, anxiety, insecurity, and other expressions of personality maladjustment or emotional instability.

The responses as well as the diagnostic practices of clinic workers reflect their general belief that physical problems may cause poor reading, and that their presence usually has an adverse effect upon the reading function. Clinicians were agreed, of course, that mental retardation limits reading performance, and that emotional or social maladjustments are more deleterious to reading achievement than are the other types of problems.

Clinicians repeatedly mentioned the difficulty of distinguishing between emotional disturbances which stem from reading failure, and those which are independent of or coincident with the reading problem. Typical procedures employed in the treatment of problems associated with poor reading are described in a later section.

THE TREATMENT OF READING DISABILITIES

About a fifth of the clinics confined their efforts to diagnosis and recommendations. The remainder provided some degree of treatment for their cases. This work was carried on, as a rule, in the clinic; some centers supervised remedial instruction of individuals in schools and homes. The extent and nature of this remedial endeavor varied considerably. However, remedial plans commonly involved one or more of the following administrative approaches: individual tutoring, small-group instruction, or summer reading classes.

Each clinic was asked whether it employed any specific 'system' of teaching reading or remedial reading. Three centers (eight per cent) replied that they used only one system, citing,

respectively, the Gates, a 'sight-list,' and the phonetic methods. Twenty per cent of the sample reported using two or more, or a combination of several, procedures. Named also, in addition to the specific systems mentioned above, were the Fernald kinaesthetic, 'whole-part', 'alphabetic-symbol', eye-span drill, and the Monroe methods. It is noteworthy, however, that the large majority of clinics—seventy-two per cent—answered this question with an unequivocal, and sometimes emphatic, 'No,'—reflecting their eclectic practice and pragmatic point of view.

Clinics were asked to state the fundamental principles underlying their remedial work. The resulting formulations show a wide acceptance of the view that the method of remediation should be adapted to the individual's needs, and that, consequently, numerous demonstrably successful techniques may be used. Many clinics stressed that the remedial program should begin at the child's level of performance, utilize interesting material, and stress success. Representative statements of remedial principles from ten clinics are listed below.

1) Adapt the method to the case and work with the child until he is up to standard grade placement.

2) Use reading material not above existing achievement level and adapted to interest of the case, facilitating coöperation and avoiding negativism.

3) Provide critical and inclusive diagnosis, systematic methods of attack, and interesting reading materials at child's reading level; treat reading as a socializing skill; build interest and self-confidence for the child.

4) Discover by trial procedures how a child learns to read, then teach the child the way he best learns.

5) Carefully plan an individualized program, take account of child's emotional needs, use great variety of devices, provide individual tutoring whenever possible.

6) Reading should be highly interesting and the whole experience at the clinic should be an enjoyable one. Materials should be carefully selected and well within the reading level of the child. New words should be presented in context and as far as possible reviewed in interesting ways.

7) First, a complete study of the child. If specific difficulties are discovered, then specific training is necessary. If general difficulties, then a general approach can be used. It is extremely important that the reading materials used are on the child's interest and ability level.

8) In addition to mechanics of reading, consider attitudes and work habits, and make efforts to supply motivation and re-orientation.

9) Proper level of reading materials, individual teaching at a time favorable to the child, make growth evident and satisfactory to the child.

10) Remedial treatment should provide instruction based upon the individual's interests, capacities, abilities, and handicaps, and also upon his need for better emotional and social adjustment. Reading instruction periods should be scheduled with regard to the greatest possible advantage to the development of the individual pupil. Materials should be based on interest appeal as well as difficulty. Activities which utilize reading should be selected whenever possible so reading may function in the lives of the pupils.

THERAPEUTIC PROCEDURES EMPLOYED IN TREATMENT OF PROBLEMS ASSOCIATED WITH POOR READING

The act of reading is part of a complex pattern of learning and adjustment in which disruption of any element may disturb the entire function. It is, therefore, not surprising that the great majority of clinics report the frequent association of many physical and behavioral problems with poor reading. Treatment of these allied problems is often an inextricable—and also invaluable—phase of the total program of remediation and rehabilitation. This is shown by the formulations in the preceding section, and also in the separate reports, of which representative citations are given below, of practices and principles followed with special reference to these associated problems:

1) Psychiatric study, adjustment of work to child's ability, health examinations, screen tests for vision (professional if necessary), special hearing tests, special speech work, lip-reading, phonetic work.

2) Psychiatric interviews (with child, parent, teacher, and others), adjustment of instruction, referral to private physician or health agency for physical correction, referral to coöperative agencies on all types of problems.

3) Application of principles of mental hygiene, instruction in study methods and ways of improving concentration, techniques for learning spelling, adjustment to curricular studies.

4) Doctor's treatment for health, etc., school for speech, parents for attitude, psychological testing as a basis, reading materials at child's level.

5) Psycho-therapy, parental counselling, removal to foster home, educational guidance, enrichment of recreational opportunities, etc.

6) Refer severe cases to psychiatric clinic. Urge teachers and parents (a) to discover tasks at which child can succeed, (b) to provide opportunities for him to engage frequently in these activities, (c) to provide wholesome play in school and home, (d) to motivate learning through creation of situations which help child realize value of ability to read.

7) School and home coöperation in giving child feeling of security. Correction of physical defects and development of good health habits. Considerable reading to children of highly interesting, attractive books. Reading classes in attractive rooms surrounded by many interesting, beautiful books. Much praise, emphasizing success.

Examination of the foregoing list reveals that methods of treatment approved by clinics vary considerably. However, certain procedures recur in the reports and may be considered basic: the application of accepted principles of psychotherapy, supplemented by the correction of physical defects through medical treatment. It should be noted that not all clinics provided treatment; some, lacking needed facilities and personnel, referred their cases to other agencies in the community for therapy.

ESTIMATED SUCCESS OF REMEDIAL PROCEDURES

Clinicians pointed out certain difficulties in gauging the success of their remedial programs. Indicating that 'success' may be a relative term, one director said: "Success is measured only by the individual's powers. This is no machine-made situation. What is success for one child is failure for another." Another worker, who refused to make an estimate, said: "Even if pupils gain two or three years in reading grade in one year as measured by tests, there are questions about the meaning of this 'growth' as well as about the validity of grade standards and the comparability of test forms. Success is to be defined relative to the individual." Another said: "If success means complete adjustment to reading, we cannot say how successful our program is. If success means evidence of growth, we do obtain that in ninety per cent of the cases." Other clinicians reported difficulty in estimating the success of their remedial work because it was conducted by the classroom teacher outside the clinic. 'Drop-out' of students at various stages in the remedial program was another obstacle to accurate evaluations.

In spite of these complications, sixty per cent of the clinics attempted to estimate the effectiveness of their remedial programs. Although it was not always possible to judge the success of the remediation in every case treated, the clinics giving information on this item reported that their estimates were based as a rule upon from ninety to one hundred per cent of their cases.

TABLE I.—ESTIMATED EFFECTS OF REMEDIAL PROCEDURES

No. of Clinics Reporting	Effects	Per Cent of Cases
10	Complete or substantial success	75–90
9	Complete or substantial success	50–70
4	Complete or substantial success	10–45
23	Average	61
4	Partial Success	50–75
18	Partial Success	5–45
1	Partial Success	0 (none)
23	Average	27
15	No Success	1–23
8	No Success	0 (none)
23	Average	5
12	Effects Unknown	5–25
11	Effects Unknown	0 (none)
23	Average	6

Examination of Table I reveals that nineteen or over four-fifths of the clinics that made estimates reported 'complete or substantial success' in fifty to ninety per cent of their cases. Averages for the various categories of success in treatment show that the clinics as a group had 'complete or substantial success' with

sixty-one per cent of their cases, 'partial success' with twenty-seven per cent, 'no success' with five per cent, and effects were 'unknown' in six per cent. Clinics which were able to follow through with their remedial endeavor and maintain close supervision of their cases until remediation had been achieved reported a substantially greater success than did those clinics where 'follow through' was difficult and 'drop-outs' frequent. Clinics whose functions were largely diagnostic and advisory, with little provision for remedial activities within the clinic, reported not only greater difficulties in estimating success, but also a smaller percentage of success.

HELPFUL BOOKS ON DIAGNOSIS OR REMEDIAL TREATMENT OF POOR READING

Of the numerous printed materials named by clinicians as helpful to them in diagnosing or treating cases of reading disability, the following ten books,[1] in order of their frequency, were mentioned most often.

Rank

1. Gates, *The Improvement of Reading*
2.5. Monroe, Bacchus, et al, *Remedial Reading*
2.5. Betts, *Prevention and Correction of Reading Difficulties*
4. Monroe, *Children Who Cannot Read*
5. Witty and Kopel, *Reading and the Educative Process*
7.5. Harris, *How to Improve Reading Ability*
7.5. Dolch, *A Manual for Remedial Reading*
7.5. Hildreth, *Learning the Three R's*
7.5. McCallister, *Remedial and Corrective Instruction in Reading*
10. Kirk, *Teaching Reading to Slow-learning Children*

Recommended by individual clinicians were professional books and monographs by Strang, Stone, W. S. Gray, C. Gray, Ewing, Fernald, Stinchfield, Orton, Stanger and Donohue, Anderson, Harrison, Baker and Leland, Center and Persons, Russell, Karp, and Kelly, Taylor, and Cole. Several yearbooks (the Twenty-

[1] It is interesting to note that all of these volumes ranked high also in a more recently compiled list of books which teachers and administrators voted as 'most useful' in the field of reading. *Cf.* Simpson, Ray H., "Reading Problems of Teachers and Administrators and Books Found Most Valuable in Meeting these Problems." *Educational Administration and Supervision*, Vol. XXVIII, October, 1942, pp. 520–8.

fourth, Thirty-fourth, and Thirty-sixth of the N.S.S.E., and the Seventeenth of the Department of Principals of the N.E.A.) were cited favorably by several workers.

About a sixth of the clinics reported the use of reading textbooks[1] (by Wilkinson and Brown, Broening, et al., Wrenn, and Cage) and of drill-type practice materials (by Brueckner and Lewis, Hegge, Kirk, and Kirk, Gates and Peardon, and Stone).

It is noteworthy that very few clinics utilized commercial drill-type materials in their remedial endeavor.[2] On the other hand, most clinics, as the section on remedial procedure shows, were aware of the fundamental importance of providing poor readers with highly motivated, meaningful materials at their current level of ability.

STUDIES IN PROGRESS

A fourth of the clinics reported that they were conducting one or more studies of reading problems. Topics for these studies, many of which are listed below, represent investigations of reading disabilities at all school levels.

1) Analysis of clinical procedures and their effectiveness.
2) Survey of reading in the local schools.
3) Word recognition at end of first school year.
4) Reading readiness experiment with mentally-retarded children.
5) Visual perception and reading efficiency.
6) Evaluating the results of remedial instruction.
7) Motivational factors in reading and academic work.
8) Remediation procedures for poor readers in college.
9) Personality maladjustment and reading ability.
10) Factors in personal history and their relation to ability.

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[1] Since 1939 many new reading textbooks have been published and, doubtless, have been put to use in clinics as well as schools. *Cf.* McCaul, Robert J.: "The Misuse of Reading Texts." *Educational Method*, Vol. XXII, April, 1943, pp. 610–14; Kopel, David: "Procedures for Evaluating Reading Textbooks." *Journal of Experimental Education.* Vol. XIII, September, 1943.

[2] Another investigator found, in 1940, a relatively greater and deplorable dependence upon narrow, drill procedures in remedial programs at the college level. *Cf.* Witty, Paul A.: "Practices in Corrective Reading in Colleges and Universities." *School and Society.* Vol. LII, November 30, 1940, pp. 564–8.

11) Tests as measures of reading ability.
12) Spatial disorientation and reading ability.
13) The relationship between reading disability and delinquency.
14) Factor analysis of reading disabilities; correlation of these factors with Thurstone's primary mental abilities.
15) Teachability of associational abilities in reading.
16) Sex differences in reading readiness.
17) Evaluation of tachistoscopic exercises in word recognition.
18) Clinical studies of reading disability.

NEEDED RESEARCH

The problems in the diagnosis and remediation of poor reading which were suggested by clinicians as needing study are listed below:

1) Materials for different reading levels on varied planes of interest.
2) Data on uses of mechanical diagnostic devices (ophthalmograph, etc.).
3) The relation of emotional factors to reading disability.
4) Development of more precise and less time-consuming diagnostic instruments.
5) Extended studies in the etiology of reading disabilities.
6) Controlled experimentation relating to improved therapeutic and remedial measures.
7) Prediction in infancy of later reading disability.
8) Value of orthoptic training exercises.
9) Elemental or uncorrelated components of reading ability.
10) Better reading tests and measures of reading capacity.
11) Effects of reading readiness measures in diminishing first-grade failure.
12) Relationship between reading problems and the amount and kind of home reading.
13) Aphasia-like performances in reading among endocrine cases.
14) Instability of vision associated with endocrine dysfunction.
15) Valid and reliable clinical methods for determining individual instruction techniques.
16) The improvement of reading in the content fields.
17) The nature of factors in the growth of meaning vocabulary.

18) Pupils' interests and attitudes at various age levels.

19) Psychological, sensory, and physical problems of the child and their relation to reading difficulties.

20) Motivational and emotional factors in learning.

21) Methods of dealing with individual differences in reading aptitude.

22) Relation of hand dominance to reading difficulties.

23) Evaluation of current standardized diagnostic reading tests as to reliability and validity.

24) A survey and evaluation of present methods of treating reading difficulties.

25) Reading difficulties at various maturation levels.

Although a few of the topics have received considerable attention in the past, none of these, perhaps, have had a definitive treatment, and further investigations may be warranted. On the whole, the topics listed provide challenging and fertile fields of research.

CONCLUDING STATEMENT

Commentaries on many of the data have been incorporated in the respective sections in which they are reported. One additional observation may be pertinent, however. This investigation was made before war engulfed our country. There is reason to believe that the clinical services reported in this study have been curtailed more or less severely as clinic personnel have entered military life. Now that the ultimate victory of the United Nations seems assured, we may begin to look forward to the resumption of many normal, constructive, civilian activities. But it is to be hoped that clinics will not merely resume their old practices and organizations; rather, it is to be desired that they critically evaluate and reconstruct their programs in the light of the best practices. It is to be hoped, too, that clinicians will be more insistent in the future than they have as a rule been in the past, upon augmenting their valuable aid to poor readers with efforts directed at eliminating those conditions in our society which create reading casualties much more rapidly than they can be cured.[1]

[1] For a discussion of fundamental economic and educational causes of poor reading, see: Kopel, David (with the coöperation of John J. De Boer), "Reading Problems of Pressing Importance." *Review of Educational Research*, Vol. XIII, April, 1943, pp. 69–87.

THE RELATIONSHIP BETWEEN READING EFFICIENCY AND ACADEMIC SUCCESS IN SELECTED UNIVERSITY CURRICULA

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Many factors are presumed to influence academic success in higher education. Among these are scholastic aptitude, study habits and reading skills, motivation, interest, place of residence, work load, etc. Considerable attention has been given to the demonstration of the association existing between these factors and achievement in various academic fields. Less attention, however, has been given to the contribution of reading efficiency to scholastic success, although the development of numerous remedial reading programs at the college level suggests the importance which clinicians give to this factor in academic achievement. It would be of value for reading clinicians to know in which curricula reading skills are most important and, further, to know the particular reading skills which need to be developed for successful work in each field. This article reports an effort to determine the relationship existing between certain reading skills and scholastic success in various curricula at the University of Minnesota.

In this study, completed in 1942, senior students were used as subjects because this permitted the measurement of both reading efficiency and achievement in a major field. In order to control the factor of age, no student was examined who entered college as a freshman before 1935. The subjects were selected from a variety of curricula in order to sample a wide range of content material: (1) forty-five in Five-Year Nursing, (2) twenty-eight in Three-Year Nursing, (3) thirty-three in Medical Technology, (4) nineteen in Dietetics, (5) fifteen in Forestry, (6) twenty-seven in Science Specialization in Agriculture, (7) thirty-eight in English Education, (8) twenty-eight in Music Education, (9) twenty-one in Social Work, (10) thirty in Social Science Education, and (11) twelve in Science Education. The sex of the students was disregarded after the analysis of variance revealed no significant differences between the mean reading scores of the sexes on each reading skill within each curriculum group.

The reading tests listed in Table I were selected with a view to obtaining measures of various reading skills considered to be

TABLE I.—MEASURES OF SIXTEEN READING SKILLS EMPLOYED IN THE INVESTIGATION

Test	Skill
Coöperative English Test, C_2, Reading Comprehension—Part 1	Vocabulary
Coöperative English Test, C_2, Reading Comprehension—Part 2	Rate
Coöperative English Test, C_2, Reading Comprehension—Part 2	Level of Comprehension
Coöperative English Test, C_2, Reading Comprehension—Part 2	General Reading Ability
Robinson-Hall—Test of Reading Ability for Geology	Rate of Reading Science Material
Robinson-Hall—Test of Reading Ability for Geology	Comprehension of Science Material
Robinson-Hall—Test of Reading Ability for History	Rate of Reading Social Science Material
Robinson-Hall—Test of Reading Ability for History	Comprehension of Social Science Material
Coöperative Literary Comprehension	Rate
Coöperative Literary Comprehension	Level of Comprehension
Chapman Cook Speed of Reading Test	Rate
Michigan Vocabulary Profiles	Science Vocabulary
Michigan Vocabulary Profiles	Social Science Vocabulary
Iowa Silent Reading Tests (Revised) Test 3	Paragraph Organization
Iowa Silent Reading Tests (New Edition) Location of Information Test 7A	Use of index
Iowa Silent Reading Tests (New Edition) Location of Information Test 7B	Selection of Key Words

important by authorities in the field of reading.[3] These reading tests were administered during the winter quarter of 1941 when each student was a senior in his respective curricula. The honor-point ratio for each student was obtained on all the subjects each student had taken and which were listed by the University catalogue as being in his major field. The scores made on the *American Council on Education Psychological Examination*, when the students were seniors in high school or freshmen in college, were employed as a measure of scholastic aptitude.

The zero order correlations between each reading skill, H.P.R.,* and scores on scholastic aptitude as measured by the A.C.E.,† appear in Table II. It can be seen from this table that, with one exception (dietetics), the zero order correlations between A.C.E. and H.P.R. is less than the correlation between H.P.R. and one or more of the several reading skills. In the case of the five-year nursing, the social science education, and the science specialization in agriculture curricula there is a negligible relationship between A.C.E. and H.P.R. in the major field so far as this study is concerned; this is in contrast to the frequently reported coefficients between A.C.E. and freshmen H.P.R. which center around .44,[4] although four of the groups exhibit this high or a higher relationship (dietetics, social work, English education and science in education). The correlations for the remaining four groups fall between zero and .44. Other studies on similar groups have reported comparable results which indicate that the association between H.P.R. and A.C.E. among upperclassmen is somewhat less than it is in the freshman year.[2] These low correlations between H.P.R. and A.C.E. might be explained by the fact that senior groups tend to be more homogeneous with reference to scholastic aptitude than are the freshman groups since the less able students are more likely to have dropped out of the course leaving behind those of superior ability.

Other studies have reported the effect upon regression equations of selection made on the basis of those regression equations.[6] The regression equations which predict success in college from scholastic aptitude and other tests have been set up as a means of improving selection procedures in colleges. As a result of knowing this relationship, counsellors have discouraged the less able

* Honor-point Ratio.

† *American Council on Education Psychological Examination.*

TABLE II.—ZERO ORDER CORRELATIONS BETWEEN SELECTED READING SKILLS (INCLUDING THE AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION) AND HONOR-POINT RATIO IN ELEVEN DIFFERENT CURRICULA

Variables	Curricula										
	Nursing 5 year N-45	Nursing 3 year N-28	Med. Tech. N-33	Dietetics N-19	Forestry N-15	Science in Agri. N-27	Eng. Ed. N-38	Music Ed. N-28	Social Work N-21	Soc. Sc. in Ed. N-30	Science in Ed. N-12
Coöp. Eng. C2 Gen l. Voc	−.07	.29	.13	.30	−.04	−.03	.29	.27	−.02	.13	.49
Coöp. Eng. C2 Gen'l. Rate	.16	.45†	.19	.27	−.04	.06	.49*	.38†	.32	.36†	.50
Coöp. Eng. C2 Gen'l. Comp	.12	.42†	.17	.14	.20	.10	.37†	.51*	.38	.20	.37
Coöp. Eng. C2 Gen'l. Read. Abil	.10	.43†	.18	.31	.04	.06	.44*	.42†	.28	.28	.50
Robinson-Hall Science Rate	.00	.06	.08	.03	.51†	.02	.40*	−.39†	.31	.07	.54†
Robinson-Hall Science Comp	.28	.21	.11	.19	−.16	−.19	−.04	.49*	.43†	.21	.05
Robinson-Hall Soc. Sci. Rate	−.01	.12	.29	.04	.58†	.07	.46*	−.25	.21	.21	.44
Robinson-Hall Soc. Sci. Comp	−.03	−.01	−.01	.01	.06	.20	.39†	.32	.23	.05	.34
Coöperative Literary Rate	.09	.36†	.18	.46†	−.11	.03	.43*	.31	.63*	.13	.53†
Coöperative Literary Comp	−.26	.34	.32	.44†	−.26	.07	.42*	.52*	.19	.23	.60†
Chapman-Cook Rate	.16	.10	.45*	.33	−.30	−.16	.39†	−.02	.34	.31	.41
Michigan Science Voc	.21	.14	.13	.02	−.01	.20	.00	−.14	.50†	.14	.14
Michigan Soc. Sci. Voc	.14	.21	.23	.23	−.40	.44†	.28	−.19	.06	.24	.64†
Iowa Silent (Test 3) Parag. Org	.06	.16	.40†	.49†	.17	−.20	.16	.31	.18	.38†	.18
Iowa Silent (Test 7A) Index	.19	.13	.09	.26	−.06	−.20	.19	.42†	.44†	.27	.28
Iowa Silent (Test 7B) Key Words	.28	.25	.18	.13	−.14	.02	−.04	.44†	.11	.37†	.78*
A.C.E.	−.01	.32	.17	.52†	.28	−.06	.45*	.35	.56*	.00	.49
† Significant r at .05. level	.29	.36	.33	.43	.48	.37	.31	.36	.41	.35	.53
* Significant r at .01 level	.37	.46	.42	.55	.61	.47	.40	.46	.53	.45	.66

students from entering college and encouraged the more promising students. This tends to reduce the range of talent in the college group and thus the sample differs from that on which the regression equation was originally computed. Since a correlation coefficient is to some extent a function of the range of scores on which it is based, the regression is less valid for use with the more selected group.

It is possible to consider whether factors other than scholastic aptitude distinguish successful from the less successful students in their senior year at the University of Minnesota. Table II contains the information necessary to determine which, if any, reading skills may be among the more discriminating factors at this level.

According to Table II the correlations of reading scores with H.P.R. range from −.39 for science rate on the music education group, to .78 for key words on the science in education group. It is immediately apparent that there are more reading scores significantly associated with H.P.R. in the two humanities groups, English education and music education, than in the other curriculum groups. Six of the sixteen reading skills are significantly associated (at the one-per-cent level) with honor-point ratio in the English education curriculum. Three of the sixteen reading skills are significantly associated (at the one-per-cent level) with H.P.R. in the music education curriculum. This is in line with Eva Bond's study at the secondary-school level where she found that the best prediction of achievement in English was the score on reading tests.[1] Six of the eleven curriculum groups reveal no significant relationship at the one-per-cent level between the scores on the reading tests used in this investigation and achievement in their respective curricula. Five of these six groups were majoring in a field emphasizing science material (five-year nursing, three-year nursing, dietetics, forestry, and science education). The sixth group, revealing no significant differences at the one-per-cent level between scores on the reading tests and H.P.R., was majoring in social science education.

Table II may also be studied for information concerning the reading skills which seem to be most highly associated with H.P.R. in different curricula. Ten of the sixteen reading skills are associated significantly at the one-per-cent level with achievement in one or more of the curriculum groups. Those reading

skills which are not significantly related to academic success at the one-per-cent level in the different areas include social science comprehension, paragraph organization, use of index, general vocabulary, science vocabulary and social science vocabulary. It may be noted that none of the measures of vocabulary are significantly associated at the one-per-cent level with honor-point ratio in any of the curricula.

With the knowledge of these zero order correlations between each reading skill and H.P.R. for the respective curricula, it was possible to construct a regression equation to predict H.P.R. in each field from a knowledge of the association of selected reading skills (including A.C.E.)* with H.P.R. in that field. This was done for the two largest groups, the five-year nursing and English education seniors. Those reading skills which were most highly associated with H.P.R. were selected, and on the basis of these the multiple correlation and multiple regression equations were obtained.

Table III shows for the five-year nursing seniors the zero order inter-correlations of the five reading skills and H.P.R. selected for the variables in the multiple correlation coefficient. The top row consists of the correlation values taken from the five-year nursing curriculum column on Table II. Table IV reveals similar data for the English education seniors. The latter table is larger because there appeared to be more reading skills significantly associated with H.P.R. than in the five-year nursing group.

In determining the multiple correlation coefficient, we are determining the association which exists between any dependent variable and a combination of independent variables. In this investigation the dependent variable is honor-point ratio and the independent variables consist of various reading skill scores weighted according to the relative contribution they individually make to honor-point ratio. The weights of these independent variables are known as beta values and are determined by the method of partial correlation. This is simply the product-moment correlation between any one independent variable and the criterion or dependent variable when the other independent variables are held constant.

* Including A.C.E. when it was one of the variables highly associated with H.P.R. in that field.

The multiple regression equation actually presents the best combination of the beta weights of the various independent variables by means of which it is possible to make an estimate of the honor-point ratio of an individual student. Given the raw scores an individual makes on these independent variables, they may be weighted in terms of the beta weights from the regression equation and the dependent variables. In this particular study an estimate of honor-point ratio may be determined by solving the regression equation.

TABLE III.—INTERCORRELATIONS BETWEEN HONOR-POINT RATIO IN FIVE-YEAR NURSING AND FIVE READING SKILLS

Variables	Science Comp.	Key Words	Literary Comp.	Science Voc.	Use of Index
H.P.R.	.28	.28	−.26	.21	.19
Science Rate	...	.27	.08	.23	.29
Key Words	...	...	−.12	.38	.29
Literary Comprehension	...	...	.....	.13	−.11
Science Vocabulary	...	...	.....	...	.03
Use of Index					

In multiple correlation the score obtained between the criterion and a number of independent variables is a single measure of the intensity of the relationship existing between the honor-point ratio and this combination of independent variables. The multiple regression, however, makes it possible to estimate for an individual the actual score he is most likely to make on a dependent variable.

After obtaining the zero order correlations recorded in Tables III and IV, attention was directed to the development of a multiple correlation for the five-year nursing students between honor-point ratio in that field and certain independent variables which in this case are scores on certain reading tests. Use of the zero order correlations of Table III produced a multiple correlation coefficient between the selected reading skills and honor-point ratio in the five-year nursing curriculum of .49. The test of significance of this value, determined by the analysis of variance,

TABLE IV.—ZERO ORDER INTERCORRELATIONS BETWEEN HONOR-POINT RATIO IN ENGLISH EDUCATION AND VARIOUS READING SKILLS (INCLUDING THE *American Council Psychological Exam.*)

Variables	Gen'l. Rate	Social Sc. Rate	A.C.E.	Lit. Rate	Lit. Level	Science Rate	Chap. Cook	Social Science Comprehension	Gen'l. Comprehension
H.P.R.	.49	.46	.45	.43	.42	.40	.39	.39	.37
General Rate	...	.37	.76	.59	.42	.25	.52	.63	.78
Social Science Comprehension	...	...	.39	.39	.16	.73	.41	.21	.27
A.C.E.	...	...	...	.69	.61	.23	.50	.60	.59
Literary Rate	...	...	...	...	.73	.35	.42	.52	.44
Literary Comprehension	...	...	...	...	...	.16	.47	.39	.49
Science Comprehension	...	...	...	...	...	...	.15	−.02	.07
Chapman-Cook	...	...	...	...	...	...	...	.32	.48
Social Science Rate	...	...	...	...	...	...	...	.....	.51
General Comprehension									

yielded for 5 and 39 degrees of freedom an F value of 2.47. The F value at the one-per-cent level of significance in Snedecor's tabled values[5] is 3.53 and for the five-per-cent level of significance it is 2.46. Thus the multiple correlation coefficient is not significant at the one-per-cent level but it is significant at the five-per-cent level. The multiple regression equation was also developed for this group, but it is of little value since the multiple correlation is not significant at the one-per-cent level.

The zero order correlations in Table IV yielded a multiple correlation coefficient between the several reading skills (including A.C.E.) and H.P.R. in the English education curriculum of .65. The test of significance of this multiple correlation coefficient yields an F value of 2.30. Snedecor's F table places the level of significance for 9 and 28 degrees of freedom for the one-per-cent level of significance at 3.76 and for the five-per-cent level at 2.56. Consequently, this multiple correlation is not found to be significant at either the one-per-cent or the five-per-cent levels.

The significance of the correlation coefficient is partly dependent upon the size of the group. Since the other nine groups are even smaller and do not appear to be capable of overcoming this disadvantage by higher zero order correlations between the various reading skills and honor point ratio in the respective fields, it was decided it would be unprofitable to continue this analysis further.

SUMMARY AND IMPLICATIONS

1. This study presents evidence which shows that the zero order correlations between honor-point ratio and measured scholastic aptitude are not as high among seniors as might be expected from knowledge of prediction studies in the freshman year.

2. In all of the curriculum groups, with the exception of dietetics, at least one factor other than scholastic aptitude, such as certain reading test scores, ~~are~~ correlated as high or higher with H.P.R. than is A.C.E.

3. Scores on the reading tests used in this investigation are shown to be frequently related to achievement in the humanities groups (English education and music education) but infrequently related to achievement in those curricula emphasizing science material.

4. It is shown to be impossible, for the five-year nursing and English groups, to develop a significant regression equation, based upon scholastic aptitude and the scores on reading tests used in this investigation, to predict honor-point ratio in these fields.

5. This study has certain practical implications for reading clinicians operating in situations comparable to the University of Minnesota. In this study it becomes clear that when a student at the University of Minnesota reaches the senior year of a certain curriculum he finds that the difference between an A and a C grade is less dependent upon scholastic aptitude than upon other factors such as reading efficiency. This should not be taken to signify that intelligence is less important than reading skills in the senior year of college. It does suggest, however, that by the time the senior year is attained the students within a curriculum are so homogeneous with reference to scholastic aptitude that other factors such as reading efficiency may make the difference between high and low scholarship. In those cases where reading efficiency is apparently essential for scholastic success, as this study shows it to be in English education and music education, it seems desirable that students be encouraged to develop the reading skills which have been demonstrated to be significantly related to academic success in their major field.

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FOLLOWING THE PATH OF LEAST RESISTANCE IN THINKING

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In all the major countries in the world those in authority are alert to the importance of controlling public opinion. Elaborate techniques have been devised for exercising such direction, methods which range all the way from downright lies to the most subtle distortions of the truth. Against all these devices the ordinary man has little chance of steering a straight course, and he will continue to be the dupe of those whose purpose it is to mislead him unless he is able to develop some counter-offensives.

The protective methods which have been urged to date have been very crude, most of them have been centered around the one theory that a man's thinking is easily distorted by his emotions; and the term 'wishful thinking' has become a common formula for describing practically all forms of logical distortion. The implication from this emphasis is that the man who can control his emotions will be able to reason accurately.

Consequently, we are admonished by those who are disturbed by the current ruthless propaganda methods to listen to all sides of an argument, to weigh all viewpoints with coolness and calm deliberation, and then to arrive at our own decision. All such exhortations are well and good, but they omit the most essential element in the whole situation; they ignore the principles of correct thinking which are involved in such calm deliberations. One can reach an erroneous conclusion in calmness as well as in the heat of passion. The fact that one can be biased by one's feelings does not imply that the elimination of the feelings will bring about clear thinking.

To state the issue in another way, in our zeal for avoiding propagandizing we have overstressed negative methods. We have centered our interest around the warning: "Do not be misled." Neither suspicion of the motives of the other person, nor misgivings about his own ability to divest himself of his emotions, will ever teach a person to think clearly.

Is it not possible that trivia may distort clear thinking? The thesis behind the experiment to be reported in this paper is that reasoning may be distorted by unemotional details, by inertia,

by simple habit patterns, by errors in perception, or the like. Our present purpose is to select some illustrative situation and to determine whether, in this restricted setting, individuals will tend to follow an habitual pattern of behavior rather than to adhere strictly to logical generalizations.

Specifically, our hypothesis is this: When given an opportunity to accept two or more equally tenable (or equally untenable) hypotheses, will an individual tend to follow the path of least resistance in his selection?

In order to put this hypothesis to a test the following requirements were set down:

1) The problem to be presented to the subject should be so simple that it could be easily understood by anyone who could read.

2) The material involved in the problem should be such that no emotional prejudices or personal feelings of any sort would be involved.

3) Several equally tenable hypotheses should be presented in such a manner that selection would be random except for the operation of some rather common tendency or habit pattern.

With these conditions fulfilled, if this common tendency could be found to dominate the selection from such equally tenable hypotheses, it could be concluded, within the limitations of the specific experiment, that an unemotional following of the path of least resistance might be a factor in a person's thinking.

THE PLAN OF THE EXPERIMENT

After casting about for materials which would meet the requirements set down above, we selected the letters of the alphabet because they seemed to be devoid of any emotional prejudices. One can hardly conceive of a person's being in love with the letter Q and hating the letter R. To be sure, a student might hate the letter X because of its connection with mathematical problems; but, on the whole, letters seem to be as little related to bias as anything which seemed usable in this problem.

The alphabet also supplies a tendency to deal with materials in a routine manner. That is, given the letters a, b, c, and d, almost anyone will tend to keep them in this normal sequence rather than to disarrange them. If, then, a person is given equally tenable conclusions which are labelled 'a', 'b', 'c', and

'd', and if he tends to rate them in this order, it would seem that his arrangement is due not to logical thinking, but to the operation of a tendency to follow his habitual trends. In such a setting a person's habits might lend weight to conclusions which have no relation at all to those habits.

The test as actually drawn up was as follows:

WHICH BUTTON RINGS THE BELL?

Suppose you have a series of nine buttons, each one designated by its own letter, as follows:

[A] [B] [C] [D] [E] [F] [G] [H] [I]

Suppose, further, that you know that one of these buttons, when pressed, will ring a bell. Your task is to discover which button rings the bell by observing a series of situations in which several buttons are pressed at the same time.

Buttons	D B A C	are pressed simultaneously and the bell rings.
Buttons	C E B A	are pressed simultaneously and the bell rings.
Buttons	A D F B	are pressed simultaneously and the bell rings.
Buttons	H A G I	are pressed simultaneously and the bell rings.

You are to rank the different buttons in order, from 1 to 9, according to the importance you attach to each one as the probable ringer of the bell. Give a rank of 1 to the button you think most likely to have rung the bell by putting in the first space below (after 1) the letter of that button; after 2 put the letter of the button you think next likely to have rung the bell; after 3 put the letter of your third choice; after 4 put the letter of your fourth choice; and so on, until you have rated all nine of the buttons. When you have finished you should have a different letter in each space. The letter in space one represents the button you think most likely to have rung the bell, the letter in space nine represents the button you think least likely to have rung the bell. The letters in the intervening spaces represent a descending series of choices.

1____2____3____4____5____6____7____8____9____

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Buttons	V O N P	are pressed simultaneously and the bell rings.
Buttons	O N Q V	are pressed simultaneously and the bell rings.
Buttons	P V R N	are pressed simultaneously and the bell rings.
Buttons	T S V U	are pressed simultaneously and the bell rings.

Do just as you did in the problem above, that is, rank the buttons in order from the one most likely to have rung the bell to the one least likely to have rung it.

1____2____3____4____5____6____7____8____9____

An examination of the first problem will show that the only button which appears in all four simultaneous ringings of the bell is A. The button B appears in three of the ringings; buttons C and D appear in two of the ringings; while buttons E, F, G, H, and I appear but once. In a similar manner, in the second problem, button V appears in all four ringings; button N appears in three ringings; buttons O and P appear in two ringings; and buttons Q, R, S, T, and U appear once. The two problems differ also in the fact that the button which appears in all the ringings in the first problem is at the beginning of an alphabetical series, whereas the button which appears in all the ringings in the second problem is at the end of an alphabetical series.

After providing these conditions, the actual arrangement of the letters in the problems was determined by chance, using Fisher's tables to insure such random arrangement. The letters on the buttons, however, as set forth in the problem are in alphabetical order. This was done in order to make clear to the subjects the fact that the letters used on the buttons could be arranged in alphabetical sequence. This arrangement involved no logical implication that the correct answers would take on an alphabetical sequence.

The test was given to two classes in psychology. One was a class of ninety-two students in beginning psychology and the other a class of one hundred eight students in abnormal psychology; two hundred students in all.

RESULTS

The responses given by all the students in both classes are presented in Table I.

Before going into the significance of these results it might be well to consider their reliability. Since V was the designation

on the button in the second problem which appeared in each combination of buttons which made the bell ring, its position is rightly at the first of the series in order to correspond with the correct button (A) in the first problem. With this adjustment

TABLE I.—RESPONSES OF 200 STUDENTS TO INDUCTION TEST

Rank order	Buttons in Problem One								
	A	B	C	D	E	F	G	H	I
1	200								
2		198	1	1					
3		1	168	31					
4		1	29	167	1		2		
5			1	1	161	8	7	18	4
6					18	160	7	9	6
7					5	15	149	20	11
8					7	8	29	149	7
9			1		8	9	6	4	172

	Buttons in Problem Two								
	V	N	O	P	Q	R	S	T	U
1	193	6		1					
2	5	193	2						
3		1	174	24	1				
4	2		24	173	1				
5				2	156	12	9	14	7
6					8	154	21	11	6
7					9	9	125	41	16
8					10	13	40	121	16
9					15	12	5	13	155

the two arrays of choices certainly follows an alphabetical sequence. In order to determine the degree of similarity between the results in the two problems, we can compare the frequency with which a straight alphabetical sequence was given in each problem. These figures are given in Table II.

Since a chi-square of 4.053 with eight degrees of freedom denotes that there are between eighty to ninety chances in one hundred that the differences between the two groups of measures can be attributed to chance, we are justified in concluding that the obtained differences between the two problems are not significant—the null hypothesis has been sustained. That is to

TABLE II.—COMPARISON OF TWO PROBLEMS

For Problem 1 are given the number of subjects who ranked A as 1, B as 2, C as 3. . . . . I as 9; and for Problem 2 the number of subjects who ranked V as 1, N as 2, O as 3, P as 4. . . . U as 9. Numbers in parentheses are 'expected frequencies' for the computation of the chi-square values.

	Buttons and rankings										
	A-1 V-1	B-2 N-2	C-3 O-3	D-4 P-4	E-5 Q-5	F-6 R-6	G-7 S-7	H-8 T-8	I-9 U-9	Sums	X^2
Problem 1..	(202) 200	(201) 198	(175) 168	(174) 167	(163) 161	(161) 160	(141) 149	(139) 149	(168) 172	1524	2.023
Problem 2..	(191) 193	(190) 193	(167) 174	(166) 173	(154) 156	(153) 154	(133) 125	(131) 121	(159) 155	1444	2.030
Sums.....	393	391	342	340	317	314	274	270	327	2968	
X^2.....	0.041	0.092	0.572	0.675	0.051	0.013	0.934	1.480	0.195		4.053

say, the subjects tended to select the button which appeared in every ringing of the bell for first place (regardless of whether that button was at the beginning or at the end of the alphabetical sequence); and they also tended to arrange the other buttons in alphabetical sequence. We shall examine more closely the significance of this alphabetical arrangement after presenting another check of reliability of our results.

This second check of reliability was made by comparing the responses of the two classes, one a class in beginning psychology and the other a class in abnormal psychology. A separate tabulation for each of the problems is presented in Tables III and IV.

Since chance factors alone could account for chi-square values as large as those found when the two psychology classes were

compared, it can be concluded that there is no significant difference in their patterns of answers.

Now let us examine the results themselves. In the problem where the button which appeared in all four simultaneous pressings was labeled A, it was selected without exception for the first

TABLE III.—COMPARISON OF TWO GROUPS IN PROBLEM 1

	Buttons and rankings										
	A-1	B-2	C-3	D-4	E-5	F-6	G-7	H-8	I-9	Sums	X^2
Beginning psychology	92	91	72	73	75	72	69	69	78	691	0.465
Abnormal psychology	108	107	96	94	86	88	80	80	94	833	0.386
Sums.....	200	198	168	167	161	160	149	149	172	1524	
X^2.....	0.028	0.025	0.384	0.176	0.100	0.006	0.066	0.066	0		0.851

TABLE IV.—COMPARISON OF TWO GROUPS IN PROBLEM 2

	Buttons and rankings										
	V-1	N-2	O-3	P-4	Q-5	R-6	S-7	T-8	U-9	Sums	X^2
Beginning psychology	89	89	80	79	67	66	53	50	67	640	0.996
Abnormal psychology	104	104	94	94	89	88	72	71	88	840	0.797
Sums.....	193	193	174	173	156	154	125	121	155	1444	
X^2.....	0.257	0.257	0.210	0.124	0.104	0.140	0.187	0.435	0.079		1.793

choice. In the second problem, where the button which appeared in all four pressings (button V) was the last in the alphabetical sequence, it was selected 193 times out of a possible 200 for first place. The failure to select it for first place by seven individuals might be attributed to a slight barrier imposed by the necessity for selecting the last item in a sequence for first place. The

difference is not statistically significant, it merely gives a hint that errors may be made when a minor complication is introduced.

A second observation is that only two persons objected to ranking the other eight buttons in a situation where A and V were obviously the correct replies. All the rest, without any protest, assigned relative positions to the other buttons. It would seem from this that these students accept the frequency of appearance of a factor as a reason for giving weight to that factor as a possible causal element.

The second choice was given by most of the students to the button appearing three times, that is, to button B in the first problem and to button N in the second.

If chance had played a predominant part in the ranking of those buttons which appeared an equal number of times, then buttons C and D would have been selected with equal frequency in the first problem, and buttons O and P with equal frequency in the second problem. Furthermore, if chance had operated in the arrangement of choices of the buttons appearing only once, buttons E, F, G, H, and I would have been selected with equal frequency in the first problem, and buttons Q, R, S, T, and U would have been selected with equal frequency in the second problem. Only ten persons out of the entire two hundred who took the test indicated any such equal weighting to buttons appearing with equal frequency. These ten arranged them in alphabetical order and then wrote a note saying that they deserved equal weight. In order to include these ten persons in our statistical tabulations, their replies were distributed equally between the buttons given equal weight. That is, five votes were cast for each of buttons C and D in the first problem and for each of buttons O and P in the second problem; and two votes were cast for each of buttons E, F, G, H, and I in the first problem, and for each of buttons Q, R, S, T, and U in the second problem.

An examination of the ratings of buttons C and D and of buttons O and P reveals that about eighty-five per cent of the rankings fit the hypothesis that the selections were in accordance with the alphabetical order. The coefficient of contingency computed between the alphabetical arrangement and the obtained rankings was found to be .59. Hence, we can conclude that the relative values assigned to buttons C and D in the first

problem and to buttons O and P in the second problem were strikingly influenced by the tendency on the part of our subjects to put them in alphabetical order.

Even more striking is the alphabetical arrangement of rankings of buttons E, F, G, H, and I in the first problem and of buttons Q, R, S, T, and U in the second problem. The coefficients of contingency between the alphabetical sequences and the obtained rating values are .83 and .78, respectively. These results cannot conceivably be explained on the basis of chance; instead the hypothesis that selection was largely determined by the tendency to follow an alphabetical sequence receives strong support.

TABLE V.—ANALYSIS OF VARIANCE BETWEEN AVERAGE RANKINGS GIVEN TO THOSE BUTTONS WHICH APPEARED BUT ONCE IN THE BELL RINGINGS

	E	F	G	H	I	Sum	Sum of squares
Problem 1.....	5.40	6.25	7.205	7.56	8.685	35.10	252.717
	Q	R	S	T	U		
Problem 2.....	5.565	6.29	7.055	7.52	8.505	34.935	249.191
Sum.....	10.965	12.54	14.26	15.08	17.19	70.035	
Sum squares.....	60.129	78.626	101.685	113.704	147.764		501.908

Source of variation	Degrees of freedom	Sum of squares	Mean square
Total.....	9	11.418	
Between means of problems.....	1	0.002	0.002
Between means of buttons.....	4	11.376	2.844
Remainder, interaction.....	4	0.04	0.010

Ratio (F) problem/interaction—0.002/0.01 equals 0.2.
Ratio (F) button/interaction—2.844/0.01 equals 284.4.

This conclusion is confirmed by an analysis of variance as displayed in Table V. The figures analyzed in this table are the average rankings given by the two hundred students to each of the buttons appearing but once in the ringings of the bell. A study of the table shows that practically all of the variance is directly related to the alphabetical sequence. Fisher's table

indicates that for four degrees of freedom for each source of variation an F value of 15.98 will be exceeded only once in a hundred times by chance. The obtained F value which indicates the significance of the variation between the means of the buttons is 284.4—a figure so large that it is inconceivable that chance could account for our results. Incidentally, the F value of the variation between problems is only 0.2, which confirms our previous finding that there is no significant difference in the results obtained from the two problems.

DISCUSSION

In interpreting these results, it is necessary to keep in mind just what was done in the experiment. The subject was told that one of the nine buttons would ring the bell. He was then given four demonstrations of bell ringing with one button common to all four ringings. No other button took part in all the ringings. Obviously, the correct button was the one which took part in all the ringings and most of our subjects made this correct conclusion.

If one has discovered the correct button, why should other buttons which have been shown to be useless (in that the bell rings without them) be differentiated on the basis of the frequency of their appearance? If A appears each time the bell rings (four times) and B appears on three of these occasions but not on the fourth, does the fact that B made three irrelevant appearances make it any more likely that it is a functional factor in ringing the bell than some other factor which appears once, twice, or not at all? Logically, the answer is "no," but our subjects obviously were swayed by the number of irrelevant appearances. We may argue all we please about the fact that frequency of appearance should not be permitted to sway our generalizations; it would seem from these results that, in this setting at least, a factor is weighted according to the frequency of its appearance.

It is quite possible that this tendency to trust frequency of appearance as supporting evidence for an hypothesis is fostered by our admonitions to students to repeat their observations and to attempt to avoid the tendency to generalize on the basis of too few cases. Our emphasis upon repetition in science may have taught our students to generalize on the basis of repetition alone.

It is possible, on the other hand, that this tendency is just as prevalent among individuals who have had no scientific training. This would be an interesting problem to investigate.

Still more striking is the tendency on the part of our subjects to be influenced by alphabetical sequences. When the experiment was set up, it was suspected that such an influence might function, but the tendency turned out to be far more striking than had been anticipated. It is quite possible that a number of students realized that none of the buttons which appeared but once could be the right ones, and it is quite possible that the arrangement in an alphabetical sequence represents no profound differentiation in their thinking between the relative significance of the various buttons. Nevertheless, the fact that they did follow a routine pattern of arranging them alphabetically may be taken as an indication that equally tenable (or equally untenable) factors will tend to be arranged in a manner which is easiest for the individual.

Putting these two tendencies together it can be seen how they might lead to chronic misconceptions in the thinking of the average man. Suppose a group of irrelevant factors appear again and again and are sorted out by an individual into the same pattern each time; what would be more easy than for him to accept the pattern thus set up as having some logical validity? At least, it would seem that if one is to guard one's thinking from error, one should avoid the tendency to give weight to a factor merely because it keeps recurring, and one should avoid the possibility of giving weight to factors merely because of the way in which they happen to be labeled or because of the tendency on one's part to arrange them in the easiest manner.

SUMMARY

A problem was given to two hundred students which required that they discover which one of nine buttons would ring a bell. The bell was rung four times by pressing four buttons simultaneously each time, the patterns of buttons changing with each ringing. By observing these combinations of buttons the subjects were to assign relative weights to the buttons as probable bell ringers.

1) The button which was present in every ringing was selected almost without exception as the one deserving most weight.

2) The button appearing three times in the four ringings was given second place.

3) Two buttons which appeared in two ringings and were absent in the other two were rated next, but they were not given equal weight. There was an extremely significant tendency to rate button C as more important than D in one problem, and to rate button O as more important than P in another problem. This preference was made in spite of the fact that C and D, and O and P, appeared with equal frequency. That is to say, the preference was determined by alphabetical primacy.

4) Buttons lettered E, F, G, H, and I in one problem, and buttons lettered Q, R, S, T, and U in another problem, were given rankings in alphabetical order in spite of the fact that they each appeared but once and, if considered at all, should have been given equal weight.

5) Within the limits of this experiment, the rating of factors which deserved equal weight was determined by the tendency to arrange letters alphabetically. An answer which purported to be a logical discrimination turned out to be little more than the free following of a simple verbal habit.

A FACTORIAL STUDY OF ACHIEVEMENT IN COLLEGE GERMAN*

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In the present study of achievement in elementary German, four criteria have been employed; they were (a) marks earned in the first semester of college German, (b) reading subtest scores, (c) vocabulary subtest scores, and (d) grammar subtest scores of the Coöperative German Test, Elementary Form O. The relationships between the criteria and other variables, including tests for foreign language aptitude, for English training, for rote memory, for reasoning, for intelligence, and for attention, have been examined by means of factor analysis.

When the investigation was undertaken, it seemed probable that the various criteria would not draw upon all aptitudes or abilities to an equal degree. For instance, it was considered possible that vocabulary achievement would be highly dependent on rote memory and relatively independent of intelligence, whereas grammar would depend chiefly on reasoning, and reading would depend upon perceptual ability and intelligence. Since semester marks are determined in part by material learned in class, it seemed reasonable to suppose that semester marks might be more dependent on ability to remember material presented by sound than were the other criteria.

It was also considered possible that the subtest scores of the Iowa Placement Foreign Language Aptitude Examination would not be equally useful in predicting the four criteria. The first subtest comprises English grammar and, accordingly, was expected to be associated with the grammar criterion—the grammar subtest of the Coöperative German Test. The second subtest score of the Foreign Language Aptitude Test depends upon the ability to grasp the meaning of esperanto sentences and

* The writers wish to acknowledge their gratitude for the assistance of the staffs of the Personnel Bureau and German Department of the University of Illinois.

from this meaning to define significant words. Since this operation was assumed to be essential in reading all languages, a significant relationship between the second subtest and the reading subtest of the Coöperative German Test was expected.

The subtests of the Iowa Placement English Training Examination measure performances common to most languages, and the writers were interested in knowing to what degree measures of English training could be used in the prediction of achievement in German. It was also considered desirable to compare the participation of the various other tests in the determination of English achievement with the participation of those tests in determining German achievement.

The present problem is essentially an exploratory one in which it is desired to observe a number of interrelationships between the criteria and tests which might be used in prediction. Perhaps the possible relationships which have been enumerated could be most explicitly verified, qualified, or refuted by the use of partial correlation procedures.

The writers, however, were interested not only in the specific possibilities mentioned, but wished also to gain as much understanding as possible of the over-all patterning of the interrelationships of the criteria and the other variables. Factor analysis was selected as the procedure which could be most expeditiously applied. The study was designed to permit an objective valuation of interrelationships and was not designed to yield weights for the purpose of predictions. It was assumed that the variables would tend to cluster in a manner such as to define factors, some of which would be meaningful. Under such conditions, the factorial equations for each of the criteria would be very informative of the exact nature of the criteria. In the present study, the variables have been classified on the basis of their factor loadings, and the concept of factor has rendered simple that which would otherwise have proven to be a very tedious exploratory problem.

Subjects for this study were students who had entered the College of Liberal Arts and Sciences in the University of Illinois in September, 1939; had completed the first semester of college German; and had enrolled in the second semester of college German[3]. None of the students had had any previous experience with a Germanic language. All students participating in the

study were given tests for rote memory, reasoning, attention, intelligence, and perceptual ability. Each student's subtest scores for the English Training, Iowa Placement Examination, and the Foreign Language Aptitude, Iowa Placement Examination, were taken from the freshman guidance examination file.*

Complete data were collected from the seventy-nine men and women students who voluntarily served as subjects.† The following list provides a brief description of each test:

1) Otis test of Intelligence, Gamma Form.

2) The reading subtest of the Coöperative German Test, Elementary Form 0.

3) The vocabulary subtest for the Coöperative German Test.

4) The grammar subtest for the Coöperative German Test.

5) Number Patterns—a reasoning test, Thurstone[7].

6) Initials Recall—a rote memory test, Thurstone[7].

7) Backward Writing—a test for the perceptual factor, Thurstone[7].

8) A test for attention—prepared for use in a study of the attention factor[8].

9) Philip's Alphabet, a test for attention[4].

10) Auditory Word-Number Test—this test was carefully patterned after Thurstone's Word-Number Test. The word-number pairs, however, were read aloud to the subjects at a predetermined rate, and the multiple choice retention questions were also presented orally.

11) Auditory Initials Recall—this test was patterned carefully after Thurstone's Initials Recall test, but was presented through the auditory mode, as was test 10.

12) Word-Number recall—rote memory, Thurstone[7].

13) Syllogisms—prepared and employed in a previous study as a test of attention[8]. This test was included in the present study as a possible test of attention or as a possible test of verbal reasoning.

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* All freshmen entering the College of Liberal Arts and Sciences at the University of Illinois are tested with a guidance battery of achievement and aptitude tests.

† Almost every student participated in the testing. Due to irregularities in attendance, etc., complete data were available for only seventy-nine of the students who were otherwise suitable as subjects.

TABLE I.—CORRELATION MATRIX

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Otis																						
2. G. Read	37																					
3. G. Vocab	28	75																				
5. G. Gram	35	65	60																			
5. N. Patt	51	18	12	15																		
6. T-I. R	31	07	06	25	26																	
7. B. W	24	16	22	28	52	−02																
8. #5	47	11	11	27	28	24	20															
9. #7	46	13	12	24	29	01	37	25														
10. A-W. N	19	08	−04	01	14	46	10	19	05													
11. A-I. R	37	02	12	33	27	66	09	27	05	46												
12. T-W. N	05	06	−06	00	15	41	03	12	24	36	31											
13. Syll	43	07	04	23	26	27	17	36	14	19	20	15										
14. #3	34	40	09	23	20	14	16	35	25	10	19	09	41									
15. Grades	38	50	59	54	22	16	21	22	26	−05	13	11	14	10								
16. E.T. #1	41	43	48	52	28	11	26	14	36	00	15	00	11	22	50							
17. E.T. #3	47	35	41	65	20	23	14	26	50	14	13	06	19	32	53	58						
18. E.T. #4	39	32	33	31	17	05	16	20	29	−05	01	10	22	20	37	55	53					
19. F.L.A. #1	52	28	32	52	25	38	18	41	26	17	33	18	32	46	38	43	70	59				
20. F.L.A. #2	52	49	36	43	31	10	32	37	17	03	11	10	19	20	37	48	54	54	46			
21. F.L.A. #3	53	12	06	31	29	27	36	37	38	03	18	07	31	36	18	36	45	42	49	50		
22. F.L.A. #4	51	10	23	24	17	16	22	34	23	01	18	15	14	09	18	31	39	51	40	63	57	

14) A test of attention—prepared and employed in an earlier study[8]. The test items were presented by means of a phonograph.

15) Grades-marks earned in the first semester in the elementary German course.

16) The first subtest of the English Training, Iowa Placement Examination, spelling.

17) The third subtest of the English Training Test, grammar.

18) The fourth subtest of the English Training test, sentence usage.

19) The first subtest of the Foreign Language Aptitude, Iowa Placement Examination, grammar.

20) The second subtest of the Foreign Language Aptitude test, inferring esperanto word meanings.

21) The third subtest of the Foreign Language Aptitude test, applying esperanto principles.

22) The fourth subtest of the Foreign Language Aptitude test, translating esperanto.

The intercorrelations of Table I were computed by the product-moment method. Seven factors were extracted from the matrix of intercorrelations by Thurstone's centroid method[5]. The first six centroid factors were rotated orthogonally to a position that permitted a ready interpretation of four of the factors, as shown in the Rotated Factor Matrix, Table II*. Two of the rotated factors appeared to be meaningless.

In making the orthogonal rotations, Thurstone's principle of maximizing the number of zero loadings and minimizing the negative projections was employed[5]. Efforts to incorporate the seventh centroid factor at several stages in the rotation showed no promise of contributing to the simplicity of the structure. It is likely that the sixth centroid factor could have remained unrotated without affecting the final solution materially.

A primary aim of this investigation was to gain a better insight into the nature of the measures of German achievement employed. In view of this, Factor I is of the greatest interest. All of the variables used as measures of German achievement (reading, vocabulary, grammar subtests of the Coöperative

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* Copies of the centroid and of the transformation matrices may be had by addressing a request to J. R. Wittenborn.

German Examination, as well as the term marks) are loaded with this factor only. The Otis test for intelligence and tests for memory, attention, reasoning, and perceptual abilities contributed nothing to this factor. At the time the study was undertaken, the supposition that the various indices of achievement might be correlated with more than one factor appeared plausible.

TABLE II.—ROTATED FACTOR MATRIX

	I	II	III	IV	V	VI
1. Otis	27	41	19	35	45	−14
2. G. Read	78	−06	00	22	09	−36
3. G. Vocab	83	−07	01	−05	16	−26
4. G. Gram	74	04	17	13	25	12
5. N. Patt	−01	11	15	14	69	−21
6. T.-I.R	06	09	82	06	09	02
7. B.W	10	07	−04	12	59	−07
8. #5	11	30	22	42	22	−06
9. #7	11	17	−05	15	59	23
10. A-W.N	−09	−01	61	05	13	−05
11. A-I.R	07	00	74	08	21	−05
12. T-W.N	−07	07	51	−01	15	07
13. Syll	06	16	20	55	15	−01
14. #3	19	16	11	62	10	06
15. Grades	65	03	07	−02	32	01
16. E.T. #1	56	26	00	−04	39	10
17. E.T. #3	59	33	13	10	32	47
18. E. T. #4	47	56	−01	01	16	13
19. F.L.A. #1	45	45	31	30	18	33
20. F.L.A. #2	45	64	03	−02	27	−23
21. F.L.A. #3	09	58	07	27	40	09
22. F.L.A. #4	17	76	10	00	17	−13

It seemed reasonable to expect, for example, that the factorial composition of the German vocabulary test would involve a memory factor. This particular possibility, as well as the possibility that marks or grades for the term were correlated with memory tests, presented by means of sound, could have been dismissed as soon as the correlations were calculated, but certain other findings were wholly unexpected, and illustrate the power of factor analysis as an exploratory method.

Since the subtest scores on the English Training, Iowa Placement Examination, an achievement test in the English language, as well as the four indices of achievement for the German language, are heavily loaded with Factor I, this factor may be reasonably regarded as a language factor. Its identity with, or close relation to, a factor of general verbal ability is an interesting possibility.

The subtests of the Foreign Language Aptitude, Iowa Placement Examination, which would be expected to participate to an important degree in a factor of language achievement, contributed little to Factor I. As a matter of fact, two of the subtests of the Foreign Language Aptitude Test showed practically no correlation with Factor I.

The first subtest of the Foreign Language Aptitude Test, English grammar, and the second subtest, inferring esperanto word meanings, showed the expected relationship with the grammar and reading subtests of the Coöperative German Test. The respective correlations were .52 and .49. These relationships between the parts of the Foreign Language Aptitude Test and the respective parts of the Coöperative German Test are not directly revealed in the factor matrix. This is due to the fact that the four criteria of German achievement form a single factor. This factor, however, correlated significantly with the first two parts of the Foreign Language Aptitude Examination.

Although the clustering of the German and English variables to form Factor I could scarcely have been anticipated, no less unexpected was Factor II, determined almost entirely by the esperanto subtest scores of the Foreign Language Aptitude Test. Other variables contributing to this factor are the Otis test and variable 18, the last part of the English Training Test. No serious attempt will be made to discuss the psychological application of this factor, but it is of considerable practical significance that most of the common factor variance of the Foreign Language Aptitude Test subtests can be accounted for in terms of a factor which is uncorrelated with any of the four measures of German achievement employed.

Factor III is the rote memory factor. Not one of the measures of achievement correlated with this memory factor. Since German achievement and English training obviously depend on some kind of memory, it appeared likely that the nature of the

rote memory factor is very restricted, and may be of limited educational significance. It is extremely interesting that presenting the rote memory tests through the auditory mode in no way affected the contribution of such tests to the rote memory factor. This observation, combined with results of an earlier study[8], suggests that the occurrence of an auditory factor in a population of normal young adults is an unlikely event, providing that all the stimuli are well above the threshold.

In Factor IV tests 8, 13, and 14, which were devised to be used in the study of an attention factor at the time the data for the present study were collected, cluster together in an interesting way. Although insufficient tests of attention are present to demonstrate without question the existence of an attention factor, it is interesting to note that the tests which define Factor IV are among those which correlated with the attention factor in "Factorial Equations for Certain Tests of Attention"[8].

Factor V is weighted with Otis, Number Series, Backward Writing, and Philip's Alphabet tests. An interpretation of this factor is hazardous, but it can be stated that all of the tests, except the Otis, are strictly non-verbal in nature, and that each of them calls for a high degree of alacrity in dealing with problems not commonly met in everyday experience.

In the present population the correlation between the total scores on the English Training Test and the total scores for the Coöperative German Test is .55 and the correlation between the English Training Test total scores and grades earned for the first semester of college German is .55. Since earlier investigators have found the averaged correlations between the Foreign Language Aptitude Test and language grades to be but .52[1] and .55[2], the value of the English Training Test as a measure of aptitude for success in the study of elementary German is apparent.

Students who failed the first semester of college German were not included in the group studied. Since students who fail the first semester's work are not allowed to continue with the second semester, the present population is comparable (in this respect) with end-of-year language classes. The fact that for such a group the total score of the English Training Test correlates more highly with semester marks ($r = .55$) than does the total score of the Foreign Language Aptitude Test ($r = .37$) attests to

the value of the English Training Test in predicting German achievement.

SUMMARY

The present study illustrates the power of factor analysis as an exploratory tool. A better understanding was sought of several indices or criteria of German achievement: course marks, reading, vocabulary, and grammar subtests of the Coöperative German Test. Several logical suppositions regarding the nature of these criteria were unsupported by the results of this study.

The contributions of this study to an understanding of the criteria and interrelations of some of the other variables are as follows:

1) German achievement and English training tests define a factor tentatively identified as a language factor.

2) Esperanto subtest scores of the Iowa Placement Foreign Language Aptitude Examinations do not show important contributions to the language factor, but tend to cluster among themselves and to a lesser degree with certain of the English Training subtests and the Otis.

3) Rote memory tests presented by sound are heavily loaded with the rote memory factor, do not contribute to the criteria, and do not tend to form an independent auditory rote memory factor.

4) Four somewhat independent indices of German achievement cluster together with English training subtests. The indices of German achievement or criteria are significantly weighted with the language factor only.

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AN EXPERIMENTAL STUDY OF RACIAL DIFFERENCES IN GENERAL MOTOR ABILITY[1]

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INTRODUCTION

Differences between various racial groups has been the source of considerable investigation and theorizing by psychologists for some time. For the most part, this interest has centered around group differences in tested intelligence. Because of the nature of the intelligence test and the procedure of standardization, the results of these investigations have been open to serious criticism. There are other measurements on which we can make group comparisons without encountering the serious obstacles confronting the mental testers. Perhaps one of the most satisfactory measurement would be a comparison of general motor ability of two or more racial groups.[3]

This component of the problem has been almost entirely neglected by the psychologist. However, such things as general motor ability,[4] height-age-weight relationship, etc., have psychological significance in a comparison of racial groups. Any hypothesis of racial superiority or equality must not be limited

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[1] This investigation was carried out at the New Mexico State College of Agriculture and Mechanical Arts. For a more detailed report of the procedure see Thompson and Dove, "A Comparison of Physical Achievement of Anglo and Spanish-American Boys in Junior High School," *Research Quarterly*, October, 1942.

[2] The writer is indebted to Professor J. B. Stroud, State University of Iowa, for reading the manuscript and offering valuable suggestions and criticisms.

[3] 'Race' as used here is not an ethnological term. In this study the term race is used in its common sense meaning and no attempt is made to show that the Anglo and Mexican constitute an ethnic division of mankind. The term Mexican is also used with some misgivings, as it is a misnomer for the group we are discussing. Spanish-American would serve our purpose better. Mexican is used because of its widespread use as a name for the inhabitants of the Southwest whose ancestors were Indians and migrants from Mexico.

[4] Motor ability, as used here, refers only to the ability to perform the events tested in the study. The writer makes no attempt to differentiate between acquired or innate ability.

to the scores made on intelligence tests as a sole basis for acceptance or rejection of the hypothesis. The assumption is made, in the Southwest at least, that the Mexican is inferior physically as well as mentally. He is assumed to be mentally retarded, physically underdeveloped, malnourished, and in activities requiring neuromuscular coördination inferior in all respects to the Anglo.

We could not substantiate an hypothesis of innate inferiority of Mexicans by showing that their level of general motor ability was below that of the Anglo. However, if we discover that the Mexican is superior on motor ability tests it will be extremely difficult to hold to a theory of Mexican inferiority.

PURPOSE OF THE STUDY

The purpose of the present study was to compare the results of equated groups of Anglo and Mexican boys on various tests involving motor abilities.[1] A second part of the study was concerned with determining what differences, if any, exist between the two groups in age, height and weight. If we find that there is no significant difference in age, height or weight (or if we equate the groups according to these three variables), we can attribute any differences in motor abilities to some factor other than age, height or weight.

As a check on the classification procedure the data were also analyzed for all boys in school, irrespective of age, height or weight.

GENERAL EXPERIMENTAL PROCEDURE

After being classified each boy was placed in one of eight categories. For experimental purposes the scores of equal number of Anglo and Mexican boys in each of the eight categories were used. In case there were more boys of one race in a particular category some of them were eliminated by means of random selection in order to equalize the number of Mexican and Anglo boys in each of the eight categories. In all cases this equation of classified groups was done prior to the administration of the tests; however, all boys in school were given the entire battery of tests.

[1] The groups were equated by classifying each boy by Neilson's three-point classification chart.

An attempt was made to control motivational factors as much as possible by conducting the experiment in a natural physical education class atmosphere. The two groups were never segregated for testing, but each boy took his test in alphabetical order. The entire experiment was conducted during regular physical education class periods over a period of weeks and the boys were not informed that they were being used as subjects in an experiment.

TABLE I.—SCORES OF ANGLO AND MEXICAN BOYS ON TESTS OF MOTOR ABILITY

Event		Equated Group			Non-Equated Group		
		N*	Mean	Diff. / σ diff.	N	Mean	Diff. / σ diff.
Baseball throw	Anglo	65	102.9 ft.	3.8	85	103.3 ft.	7.2
	Mexican	65	117.1 ft.		104	124.1 ft.	
Base running	Anglo	51	12.32 sec.	5.6	75	12.39 sec.	3.2
	Mexican	51	11.45 sec.		67	12.00 sec.	
Chinning	Anglo	72	3.7 times	2.3	95	3.7 times	3.9
	Mexican	72	4.8 times		107	5.5 times	
60-yard dash	Anglo	65	9.8 sec.	2.58	81	9.8 sec.	3.5
	Mexican	65	9.5 sec.		95	9.4 sec.	
Jump-and-reach	Anglo	58	11.69 in.	2.84	79	11.44 in.	4.2
	Mexican	58	12.35 in.		82	13.04 in.	
Shot-put	Anglo	71	19.4 ft.	1.52	96	19.0 ft.	3.8
	Mexican	71	20.6 ft.		113	21.8 ft.	

* The number (N) of boys participating in the non-equated group vary from test to test because the tests were administered only once; any boys who were absent on the day that a particuliar test was being given were automatically excluded.

Subjects.—In the study the entire male population of the Las Cruces, New Mexico, junior high school was used. This school population was composed of two hundred thirteen boys, one hundred Anglo (forty-seven per cent) and one hundred thirteen Mexican (fifty-three per cent).

The Tests.—The following tests were used in the study: baseball throw for distance, base running, chinning, sixty-yard dash, jump and reach, and the shot put. An attempt was made to select events requiring different motor abilities such as throwing, running, pushing, pulling, jumping, etc.

RESULTS

1) When equated according to age, height and weight the Mexican boys were superior in all events tested and significantly superior in all but the shot-put. The results of this equated group are shown in Table I.

2) There were no significant differences in age, height or weight for the two groups. The results of this analysis are as follows:

	N	Mean Age	Mean Height	Mean Weight
Anglo boys.....	100	12.60	61.15	89.48
Mexican boys....	113	12.82	60.47	90.67

None of these differences were significant, the diff./σ diff. being 1.4 for age, 1.1 for height, and .45 for weight.

3) An analysis of the data for the non-equated group (i.e., all boys in school) showed that we can be confident at the one-percent level or above that the Mexicans were superior to the Anglos in every event tested. That is, we can reject the null-hypothesis with a very high degree of confidence.

DISCUSSION

If motor abilities can be assumed to result from either hereditary or environmental factors; then, if the assumption is made that Mexican children are handicapped (environmentally) by poor home and dietary factors, there is some justification for attributing any superiority of the Mexicans to hereditary factors. There is little doubt that the general level of environmental factors such as home conditions, dress, nutrition, etc., for the Mexican is below that of the Anglo. Granted this basic assumption, it is difficult to explain how Mexican children of allegedly inferior stock, reared in inferior homes, could be superior to Anglo children coming from better homes and supposedly superior racial stock.

No attempt should be made to generalize to the entire Mexican population from a study which was concerned with only one school population. However, it seems feasible to consider the results of this study difficult to explain if one holds to a theory of Mexican inferiority. If the Mexicans are inferior to the Anglos (as a race), it is hard to explain why an entire junior-high-school population representing a certain age group from a

town of eight thousand inhabitants should be superior to the Anglos. Las Cruces is located only forty-two miles from Juarez, Mexico, and the Mexican population is anything but atypical. It might be argued that the Mexicans living in town are superior to the average rural Mexican. However, the same argument should hold for the Anglos.

An important factor in any test of this kind is motivation. It is possible that the Mexican boys were more highly motivated than the Anglo boys due to their alleged inferiority. However, the experimenter noticed nothing of this sort operative before or during the tests. The majority of the boys had played together over a period of years and during the two years that the writer was in charge of their physical education program no racial motivational factors were apparant in their play activities. They played together and against each other, but never with racial segregation as a factor in team groupings. It is impossible to completely rule out motivational factors; however, we must remember that if the Mexicans had a racial motive to do better than the Anglos, then certainly the Anglos were also highly motivated to prevent this.

A possible explanation for the superiority of the Mexican boys may be that they lead a more vigorous physical life from pre-school days on. There seems to be less parental supervision of the Mexican children and poor home conditions would tend to drive them elsewhere for play activities. It is common to observe Mexican boys from four to seven years of age engaged in play activities of the gang variety more often than Anglo boys of the same age; the young Anglo boys engage in play activities with smaller groups, i.e., at home with one or two children from neighboring homes.

Results

SUMMARY

1) Two groups of junior-high-school boys—one hundred Anglo and one hundred thirteen Mexican—were equated according to age, height and weight; then given motor ability tests.

2) When equated according to these three factors it was found that the Mexican boys were superior in all events tested and significantly superior in all but the shot-put.

3) No significant difference was found between the age, height or weight of the two groups. The Mexican boys were .22 years

older on the average; .68 inches shorter; and 1.19 pounds heavier. These differences, however, were not great enough for us to be confident that they were due to anything other than chance factors.

4) When all boys in school were compared (irrespective of age, height and weight), we found that the Mexican boys were significantly superior in all events tested. We can be confident at, or above, the one-per-cent level that these obtained differences were not due to chance.

5) No attempt was made to substantiate an hypothesis of racial superiority for either group; however, it was shown that an hypothesis of Mexican inferiority would find the results of this study embarassing.

A SIMPLE DEVICE TO INDUCE RAPID READING

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In remedial reading instruction it is sometimes desired to have the student read at an uncomfortably rapid rate, with fair comprehension. The expectancy is that his normal reading rate will thus be enhanced.

The student is sometimes urged to carry out the exercise in his ordinary reading situations, being encouraged to skim the material more or less, but to try to get the gist of it. Many students complain that this task is impractically complex: exaggerated attention goes either to speed or to comprehension, to the considerable detriment of the other. The result is apparently poor practice for normal reading.

It was thought that the exercise might be simplified and made more useful through the use of a 'pacing' device, by means of which the proper rate of reading could be indicated to the student as he read. The student's attention might then be more concentrated upon comprehending well in limited time intervals, presumably a useful practice. The "Harvard Films for the Improvement of Reading"[1] were used as a pacing device at Princeton, but students frequently complained that the reading situation which the films imposed (the successive exposures of discrete phrases) was unnatural and somewhat bewildering. The Metronoscope[2] would supposedly be subject to the same sort of objection. Reading in time with a metronome[3] or reading ahead of a cover which progressively blots out the material read[4] would also seem to impose too close restriction upon the individual style of reading and to produce considerable distraction of attention.

Another possible pacing device consists in requiring each student to read silently from his own copy of a given printed selection under the following conditions. The class begins reading upon a signal from the instructor and is informed orally at the moment when each successive two hundred or two hundred fifty words should have been read, at the chosen rate. The students are instructed to avoid falling behind the signaled rate and are required to cover up the selection when the final signal is given. One student is then chosen to give a brief oral summary of

the material read, and comprehension is further checked by an informal vocabulary test on words selected from the passage. The 'class' may of course consist of one student, or of many.

This device seems to possess the several advantages of simplicity, face validity, and desirable normalcy of reading situation. When students in the Princeton remedial reading class failed to improve materially with encouragement and the use of the Harvard Films, the program was supplemented by this pacing technique, and considerable immediate improvement was noted. The new program, during seven weekly meetings in the fall term, was accompanied by a change in mean reading rate from two hundred seventy-two to four hundred twenty words per minute. The change in the spring-class rate, in six meetings, was from three hundred to four hundred sixty words per minute. In neither case was comprehension score lowered, change being from a mean of sixty per cent to a mean of seventy per cent (of questions answered correctly) in the first case, and from sixty per cent to sixty-three per cent in the second. All measurements were made with the Harvard "Equated Transfer Reading Selections,"[1] and the supplementary exercises were taken from *Read and Comprehend*.[5] The pacing rate for these exercises was usually set at one hundred thirty to one hundred seventy per cent of the last mean rate scored by the class, and the time devoted to them was from ten to thirty minutes during each meeting. The results were obtained from about thirty students in all, and can be considered only tentative.

By their own testimony, the students in these classes were not practicing to a material degree outside of class. The weekly class practice was not great, even when the exercise afforded by one or two readings of Equated Selections is considered. It therefore seems highly probable that the method used, if it were indeed responsible for improvement, was not so much increasing the student's skill as it was demonstrating his latent possibilities to him and encouraging him to use these possibilities. The important factor in the entire method seems to have been the supplementary pacing technique: the method has in later classes been reduced nearly to that technique alone, with no evident loss in effectiveness.

It may be suggested to the student that he adapt this pacing device to individual practice. He can do so by marking a

practice selection at each point which should be reached in successive minutes or half-minutes at the chosen rate. The student may then read by himself, glancing up as he reaches each mark to check his rate against a simple timer, modifying his rate as necessary to keep up pace, and working at all times for good comprehension.

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BOOK REVIEWS

ELOISE B. CASON. *Mechanical Methods for Increasing the Speed of Reading.* New York: Teachers College, Columbia University Contributions to Education, No. 878, 1943, pp. 80.

During recent years the emphasis upon mechanics in the teaching of reading, especially to improve speed, has been enhanced by the development and promotion of machines like the metron-o-scope, the flashmeter, the opthalm-o-graph and certain film devices. This trend has resulted in the pacing of eye movements and many other speed exercises. Competent workers in the field have criticised this trend, especially with reference to its implication for the fundamental objectives in reading. Additional evaluation of the mechanical techniques for improving speed of reading is needed. In the present study, an attempt is made to measure the effectiveness of the mechanical approach as compared with motivated practice for increasing speed.

Two groups of children, near the end of the third grade, were subjects. Each group was divided into two subgroups matched on the basis of initial reading ability. Children in one subgroup were given motivated library reading while those in the other were trained in reading phrase material in School A, and metron-o-scope material in School B. The training lasted for four weeks. The following initial and final tests were given: a standardized reading test, non-standardized tests of phrase reading, ability to phrase in oral reading, recall on metron-o-scope reading, and recording of eye movements.

The results reveal no significant differences in improvement in reading for the students trained in phrase reading or in eye movements on metron-o-scope in comparison with those who did motivated library reading. That is, free library reading resulted in the same gains as programs stressing mechanics of reading. The gains achieved by good, medium and poor readers were somewhat different.

Unfortunately one subgroup, due to conditions beyond the control of the experimenter, was trained in the presence of the other. One may criticize the technique of measuring eye movements. Counting by direct observation is inaccurate and photographic records of a 25-word selection are apt to be unreliable.

Much of the data, however, reveal valid trends. Some readers will consider that too little emphasis is given to the implications of the findings with regard to the teaching of reading.

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WERNER WOLFF. *The Expression of Personality.* New York: Harper & Brothers, 1943, pp. 323.

The author presents the results of his cleverly conceived experiments designed to show that human 'inner personality' is reflected in such external manifestations as gait, voice, handwriting, facial expression, etc. By matching and judging techniques, Wolff finds that the characterological data for individuals agree well with the personality estimates derived from only such external expressions as mentioned. Different expressions (e.g. voice and handwriting) are more frequently judged as belonging to given persons than would be expected by chance. This is taken as presumptive evidence of the working of the inner personality—acting as a common denominator of various external indicators. Especially provocative findings are the frequent inability on the part of the subject to recognize his own external expressions, and highly polarized subjective evaluations of these forms of expression. The results of specially devised memory and association experiments are related to inner personality dynamics.

The book is not intended as a guide for personality diagnosis in the clinician's office. It is admittedly exploratory in applying the scientific (experimental) method to 'depth' analysis. For thoughtful students of personality it should provide welcome relief from static personality concepts and afford a stimulating background for further research. Its virtues lie in its originality and the utter lack of any 'air of finality.'

The book suffers from occasional ponderous passages, and the reader will have to accustom himself to a somewhat tedious terminology. Some confusion ensues from the use of the phrase 'language of personality' in both a literal sense and as a simile. These, however, are slight inconveniences to be borne with grace in reaping so rich a harvest as the author provides.

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L. A. PENNINGTON, ROMEYN B. HOUGH and H. W. CASE. *The Psychology of Military Leadership.* New York: Prentice-Hall, Inc., 1943, pp. 288.

A book on military leadership is certainly timely. The value of it, of course, is to be determined by the significance of content selection and effectiveness of presentation. The need for this type of volume is well expressed by Brigadier General Wilton B. Persons in the foreword to the book wherein he advises that "since our destinies are in the military balance, it becomes imperative for us to cultivate our knowledge of military science, to develop an appreciation of military problems. Thousands of us who are not serving with the millions already in uniform doubtless soon will be, and if we are wise we will increase our effectiveness to the nation and enhance our opportunities when we enter the armed forces by gaining an understanding of the problems we will face."

The subject-matter of the book is presented in ten chapters, two devoted to the officer as an instructor, and one each to the officer as a learner, a leader, a disciplinarian, and a personnel technician; one chapter each is devoted to considerations of adjustments to military service, the officer and his men in battle, and the officer and army morale.

The two chapters on the officer as an instructor present in relatively concise language the best ways to use the Army's approved method of instruction. To educators who are not familiar with the Army's approved method of instruction, some of the words used may remind them of Herbartian steps. For example, the applicatory system as given includes the following five stages: (1) preparation, (2) explanation, (3) demonstration, (4) execution, and (5) evaluation. This may not, in terms of captions, sound like the descriptions of the purposeful thinking processes for a purposeful learner, but the discussion of the teaching method is not as Herbartian as the words suggest. Then, again, it must be remembered that for Army purposes instruction for creative activity is much less often the goal and the major effort in teaching is in imparting tested and practical knowledge and skills. The chapter on an officer as a learner is again done very compactly, and psychological knowledge contained therein is mostly taken from two sources: Garrett's *Great Experiments in Psy-*

chology and Gates' *Elementary Psychology*. The experimental bases for the generalizations and suggestions given are not included, but justifiably so. In "The Officer as a Leader" the factors emphasized are: knowledge of profession, decisiveness, force and aggressiveness, knowledge of men, tact, energy, loyalty, initiative and enthusiasm, humanity, appearance, and courage. The underlying theme seems to be based on a quotation from General Lee, which reads: "I cannot trust a man to control others who cannot control himself." A very succinct and fairly good chapter is the last one on the officer and army morale. In this chapter the reports of the National Morale Commission and Watson's *Civilian Morale* are effectively used.

Without discipline, orderly organization and function in the Army would be impossible. The chapter on discipline, generally speaking, is well done. The validity of some of the illustrations, however, might well be questioned. For example, the defeat of the French Army in 1940 is attributed to a relaxation of discipline. And the undermining of discipline is ascribed to the formation of soldiers' committees regularized in the French Army in 1936 by Monsieur Leon Blum's regime. This generalization is based on a quotation from *The Diary of a Staff Officer* written by an anonymous writer. Is that really the reason for the French defeat? Lack of discipline is certainly undesirable, but a questionable illustration of this nature is no proof of the fact.

The chapter on the officer as a personnel technician is presented in almost outline form. Job analysis is briefly described. All an officer is supposed to know about psychological tests is presented in eight pages. These pages include a discussion of classification tests used in the Army, aptitude tests, and trade tests. These are described in very general terms. For the officer who himself is not a personnel technician, this is probably sufficient for an interpretation of the more specific work to be done by the technician himself, who is supposed to have psychological training. What officers should know about interviewing is presented in much the same fashion. The need for an orderly approach and utilization of all types of evidence is emphasized.

The discussion of the officer and adjustment to military service is adequate for the purpose. In the brief discussion on intelligence and adaptation to Army life, some of the statements made are all too arbitrary and probably would not hold water in many

instances. For example, take this statement about the IQ: "It is specifically noted, in this connection, that those men with intelligence quotients 70 or below are neither drafted nor allowed to enlist. Any man with an IQ below 70 is designated as feeble-minded and is disqualified at induction centers on the basis of mental deficiency." Induction center testing, as it is being done in this war, will not correspond with this type of literal statement concerning 70 IQ as the criterion for value in the Army.

In the chapter on the officer and his men in battle suggestions concerning hunger, thirst, malnutrition and other problems are quite to the point. As proof of the fact that body build and temperament are somewhat related, Shakespeare's Cassius, who "has a lean and hungry look" is given. It is questionable whether fat men would pass an examination for military leadership, though. Some of the fat boys who are not sent to the Officers Candidate School because they are overweight would like to get a chance at an Army where nutrition is evaluated a la Shakespeare.

In spite of the fact that each of the chapters contains some element that might easily enough be elaborated and that some of the content presented cannot stand a critical analysis, as a whole the book has within it enough content well enough presented to be of use to all men who are in or wish to enter military service and attain military leadership in some capacity.

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